1888

K/HS-115

ORGDP

OAK RIDGE GASEOUS DIFFUSION PLANT

MARTIN MARIETTA

RADIOACTIVITY AIR MONITORING RESULTS FOR CASCADE STANDBY

P. B. LOWE

DECEMBER 1, 1986

OPERATED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

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RADIOACTIVITY AIR MONITORING RESULTS FOR CASCADE STANDBY

P. B. Lowe

Oak Ridge K-25 Site
Oak Ridge, Tennessee 37831-7314
managed by
MARTIN MARIETTA ENERGY SYSTEMS, INC.
for the U.S. DEPARTMENT OF ENERGY
under Contract DE-AC05-84OR21400

Martin Marietta Energy Systems, Inc.
Oak Ridge Gaseous Diffusion Plant
Oak Ridge, Tennessee 37830

RADIOACTIVITY AIR MONITORING RESULTS FOR CASCADE STANDBY

The U. S. Department of Energy (DOE) announced on June 5, 1985, that the Oak Ridge Gaseous Diffusion Plant (ORGDP) would be placed into standby status by the end of the fiscal year. The DOE standby plan that was initiated called for removing the hexafluoride gas from the purge cascade and maintaining the equipment at a positive atmospheric pressure. Although the process gas was purged, it was suspected that the change from a negative atmospheric pressure to a positive pressure could result in out leakage of residual process gas.

In July of 1985, a formal continuous air sampling program was started to determine the extent of airborne radioactivity due to out leakage. This sampling program was administered from August 1985 through July 1986 by the ORGDP Health Physics Group.

Gast oil-less vacuum pumps were used for sampling possible airborne contaminants. The pumps were calibrated to a flow rate of 20 liters per minute and airborne uranium compounds were collected on a 37 millimeter membrane filter. The ORGDP laboratory analyzed the samples for Technetium (Tc-99), beta, and uranium alpha by leaching Tc-99 and uranium from the air filter with a 4 molar nitric acid. Uranium was electroplated and counted on an alpha spectrometer to determine the uranium alpha activity. Beta activity was measured by liquid scintillation spectrometry. If a significant amount of both alpha and beta activity were detected, Tc-99 was then separated from the uranium and its daughters by hydroxide precipitation using an iron carrier. The Tc-99 was oxidized to the +7 state so it did not coprecipitate with the uranium and iron. An aliquot of the supernate was counted on a liquid scintillation spectrometer to determine the Tc-99 beta activity.

A total of 1,898 samples were collected from buildings K-27, K-29, K-31, and K-33. Samples were allowed to decay for 24 hours before being analyzed at the laboratory to allow any naturally occurring radiation to decay before analyses were performed. Two hundred and two samples were

collected from the K-27 Building that exceeded 1,000 disintegration per minute gross beta which required analysis for Tc-99. The K-27 Building was the only building with air samples that required Tc-99 analysis.

The maximum airborne activity for the samples analyzed for Tc-99 is shown in Figure 1. The plotted data indicates that airborne contaminants did not exceed the ORGDP Initial Action Level (IAL) of 22.0 dpm/m3 in buildings K-29, K-31, and K-33. However, an elevation of airborne contaminants was observed in building K-27 where the removal of intermediate and light molecular weight gases from the top of the cascade was performed. Two samples collected exceeded the IAL and are shown in Figure 2. Airborne results from the 12 months prior to standby and the results 12 months after standby are shown graphically in Figures 2, 4, and 5, respectively. Average and maximum airborne results for buildings K-29, K-31, and K-33, are shown in Figures 6-11. In order to compare results of the air sampling to the plant derived levels, see Appendix I.

CONCLUSION

Analysis presented in this report justifies a basic conclusion that although airborne levels of alpha and Tc-99 increased under standby conditions, no radiological protection guidelines for airborne contaminants have been exceeded. However, building K-27 will remain on the routine air sampling program until the averaged sample is less than 2.2 disintegration/minute/meter3.

FIGURE 1

K-27 Building
K-402-9 Areas
Aug 85 thru Jul 86

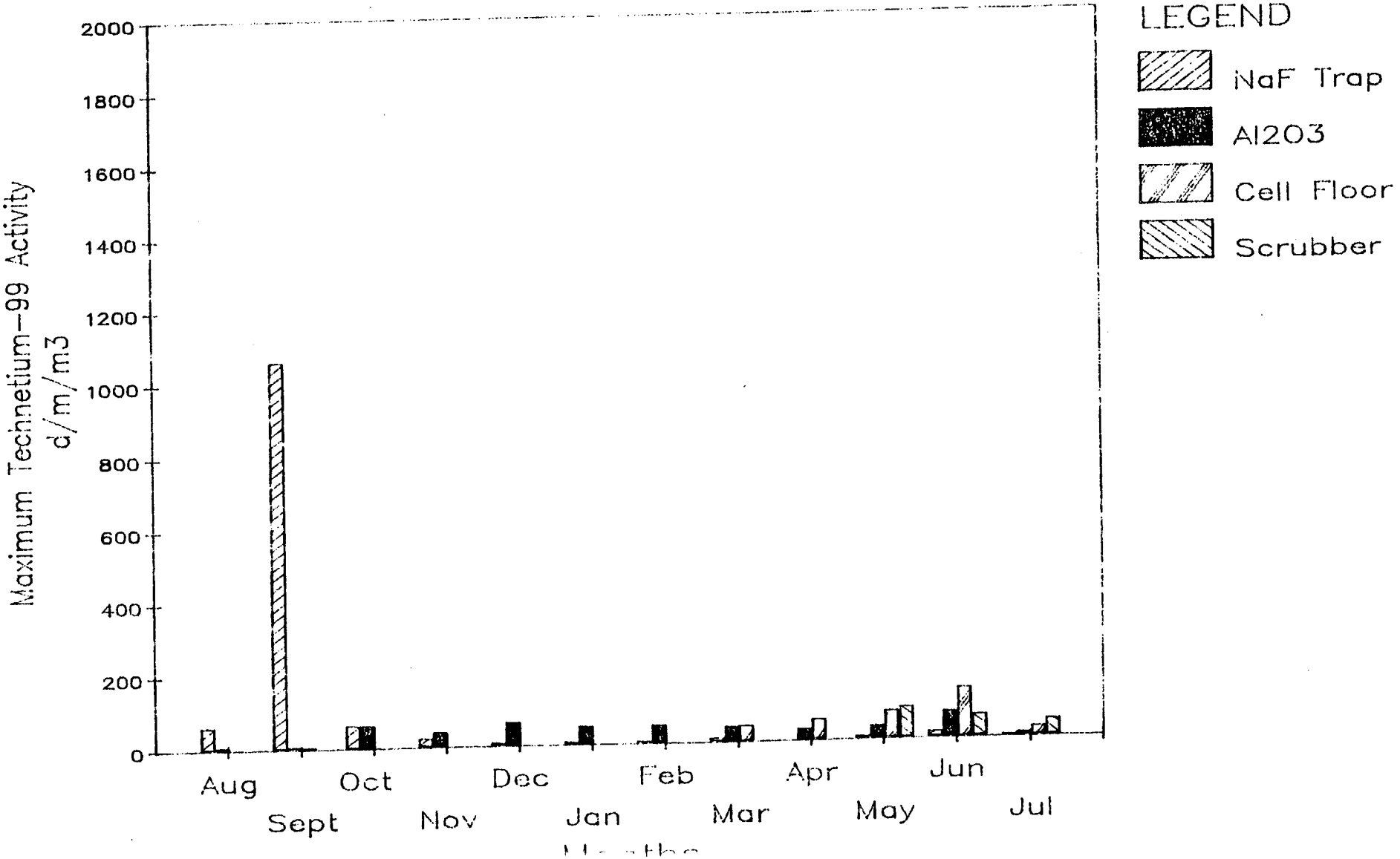


FIGURE 2

K-27 Building
K-402-9 Areas
Aug 85 thru July 86

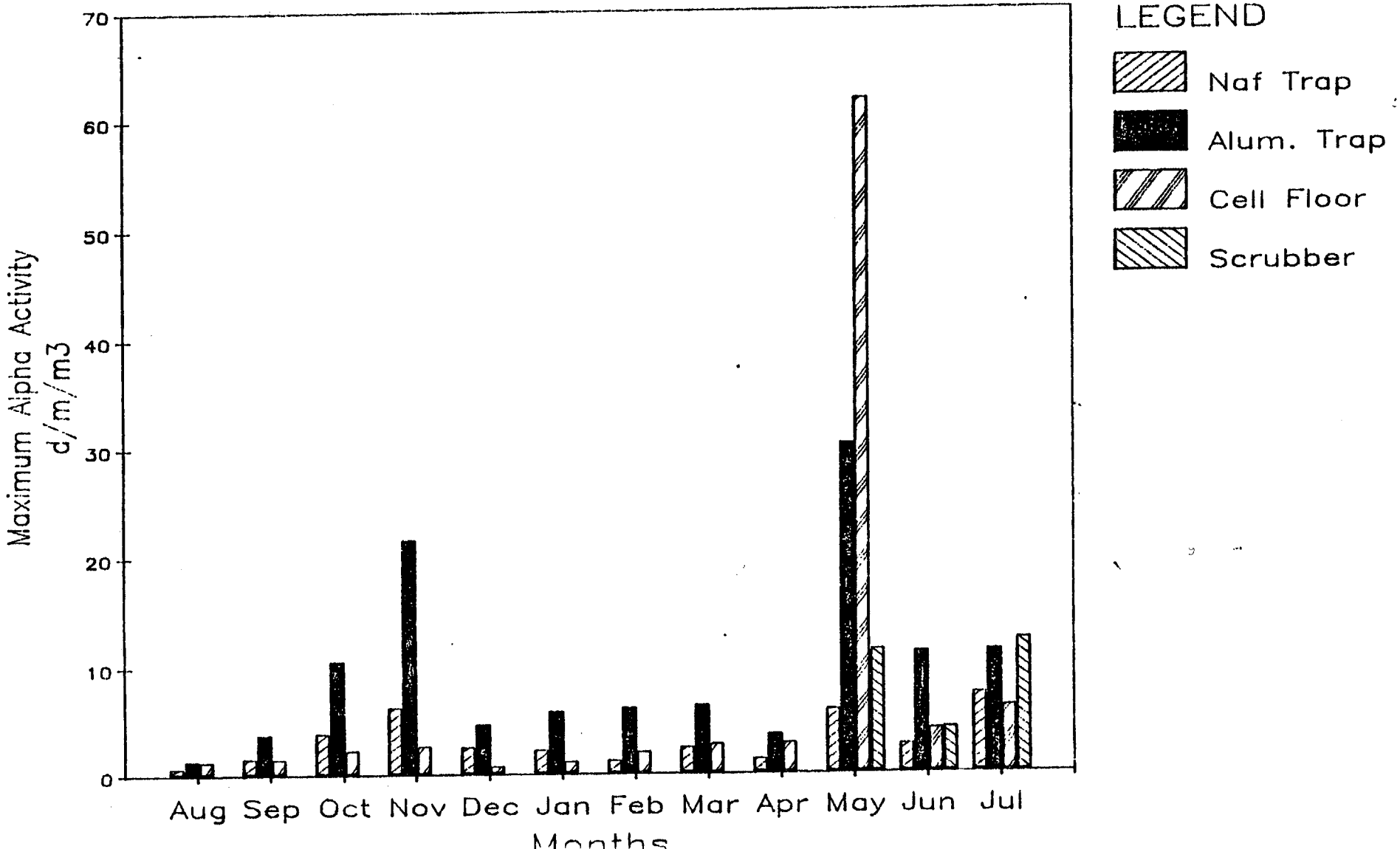


FIGURE 3

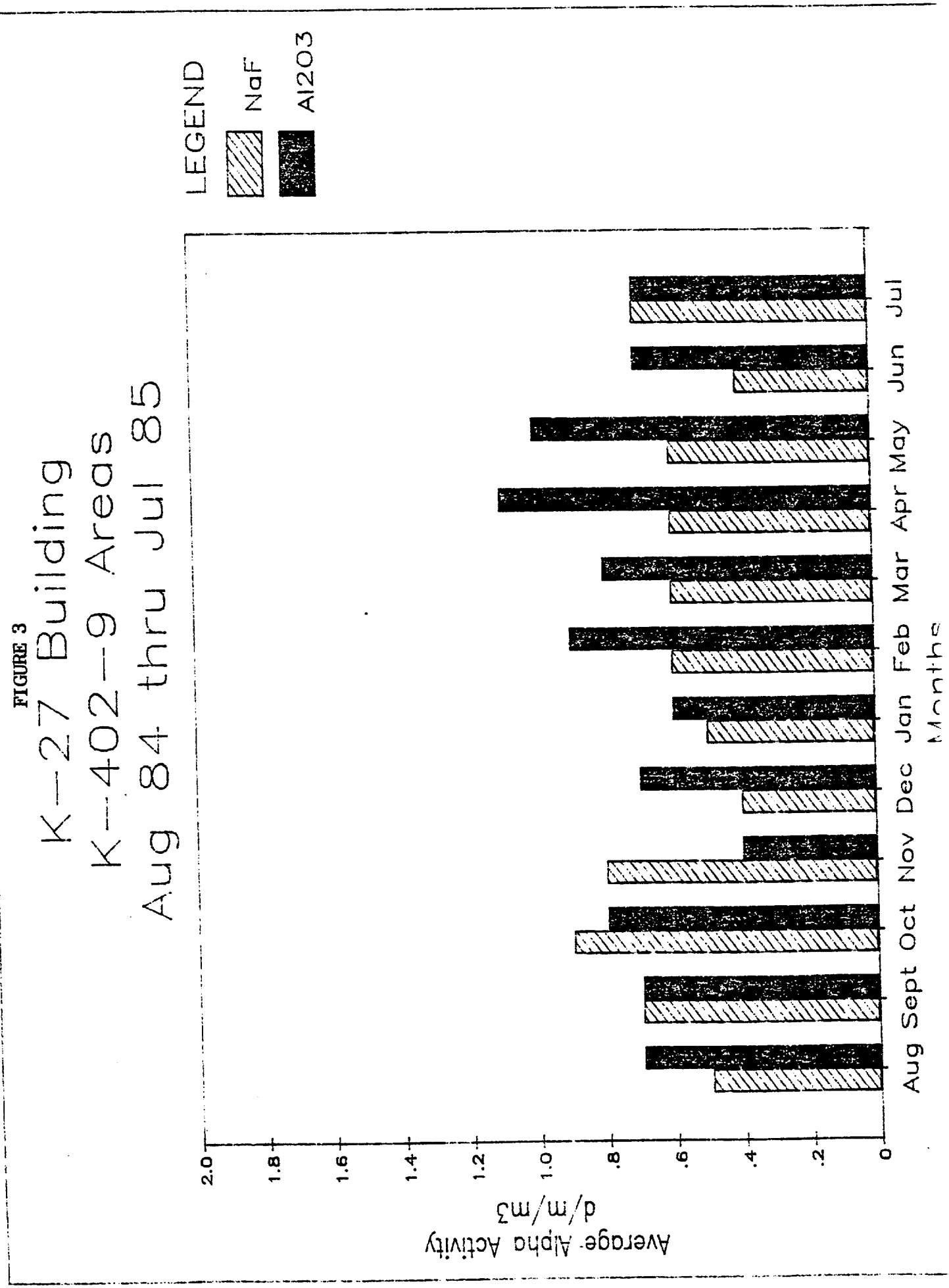

K-27 Building
K-402-9 Areas
Aug 84 thru Jul 85
LEGEND
NaF
Al2O3
Average Alpha Activity
d/m/m3
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
Aug Sept Oct Nov Dec Jan Feb Mar Apr May Jun Jul
Months

FIGURE 4

K-27 Building
K-402-9 Areas
Aug 84 thru Jul 85

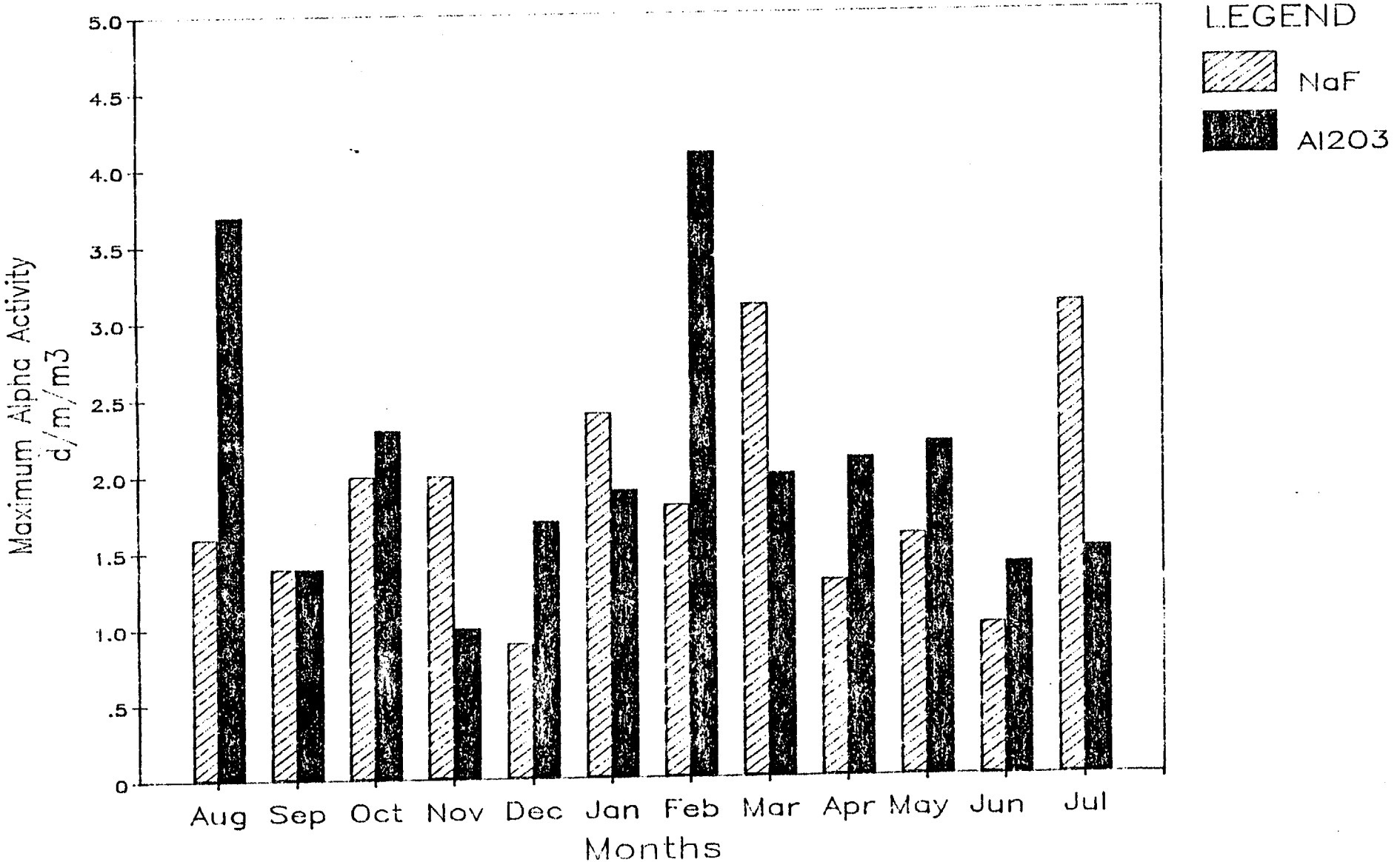


FIGURE 5

K-27 Building
K-402-9 Areas
Aug 85 thru July 86

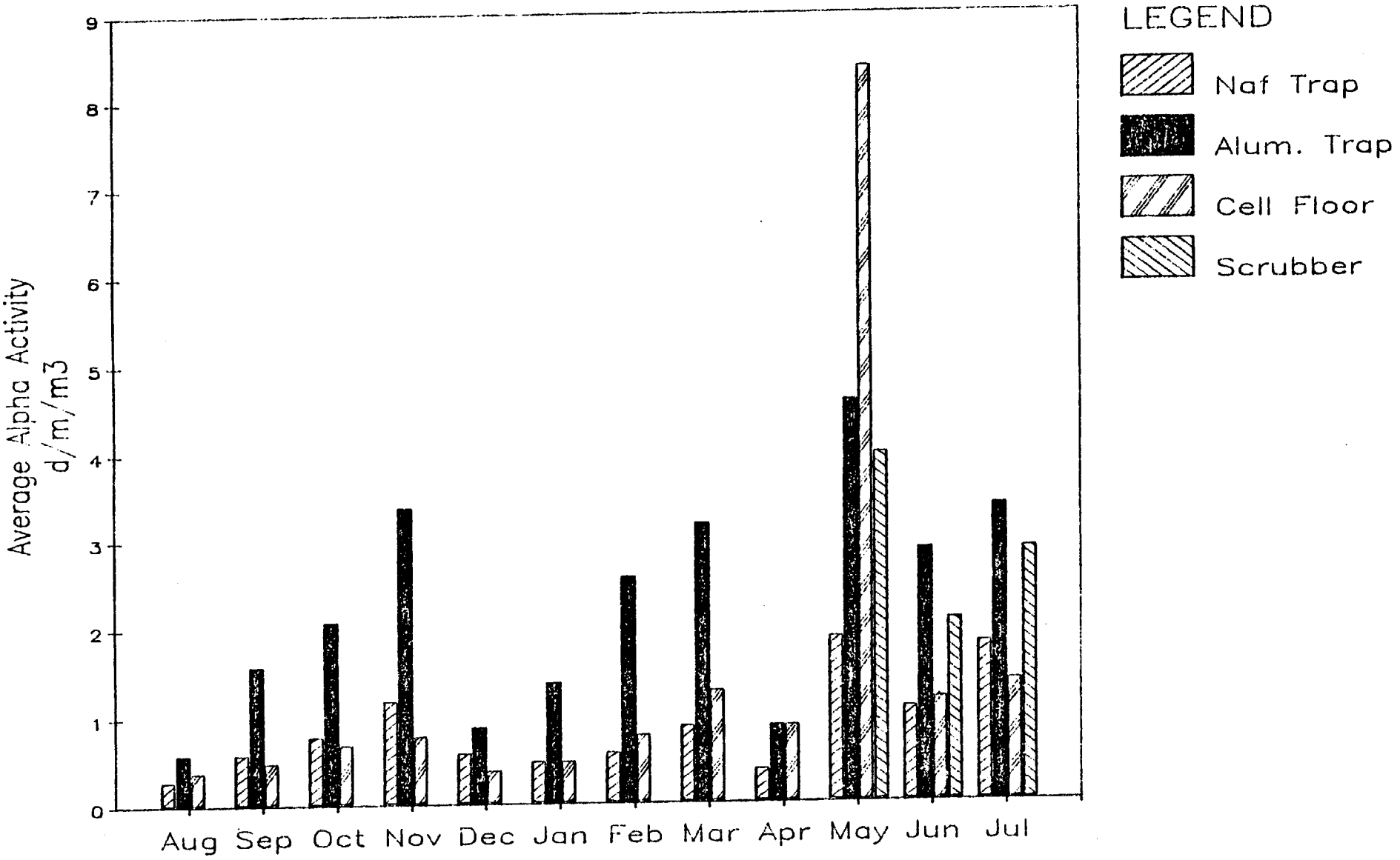


FIGURE 6

K-29 Building
Quadrants 1 thur 4
Aug 85 thru July 86

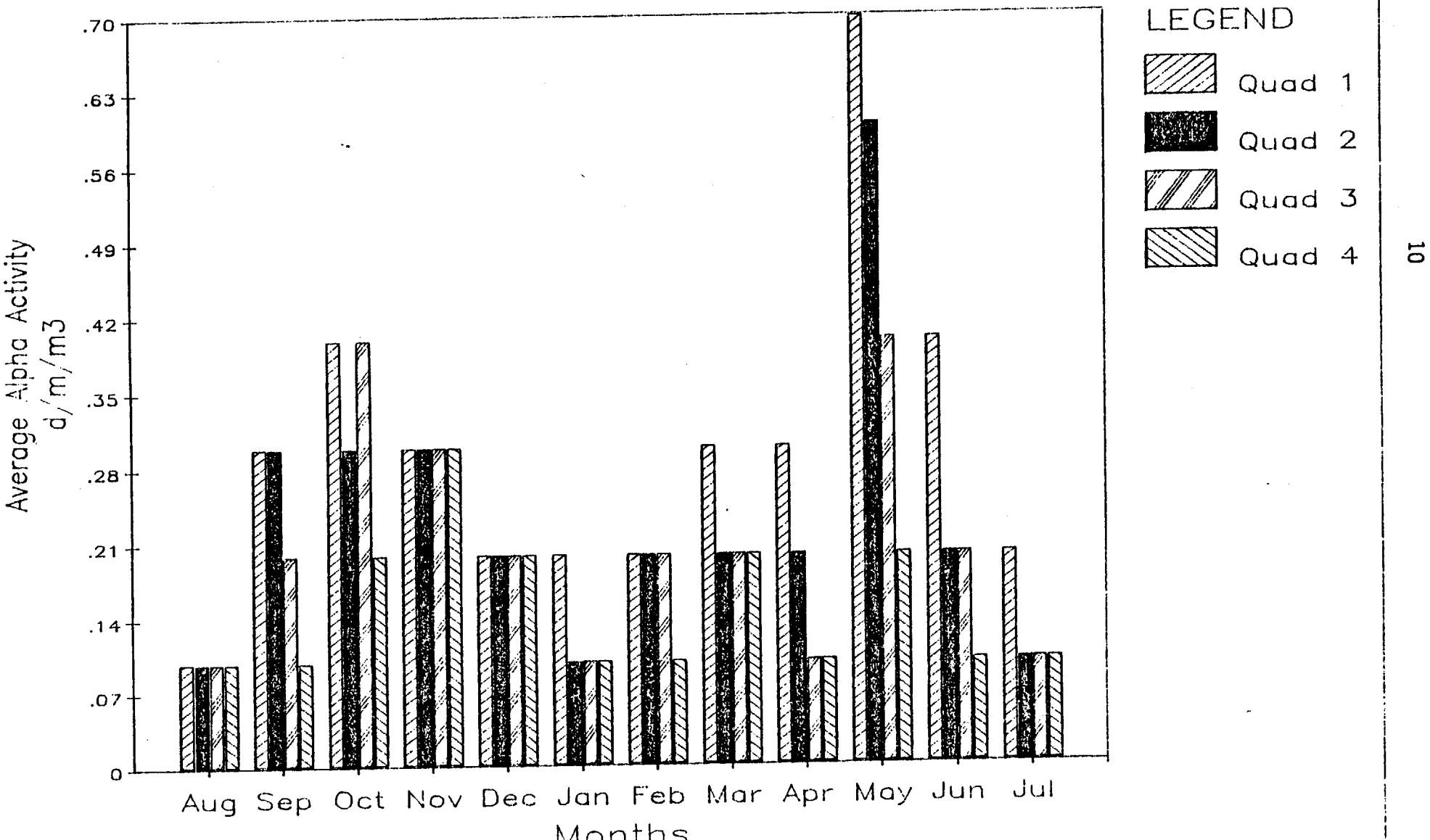


FIGURE 7

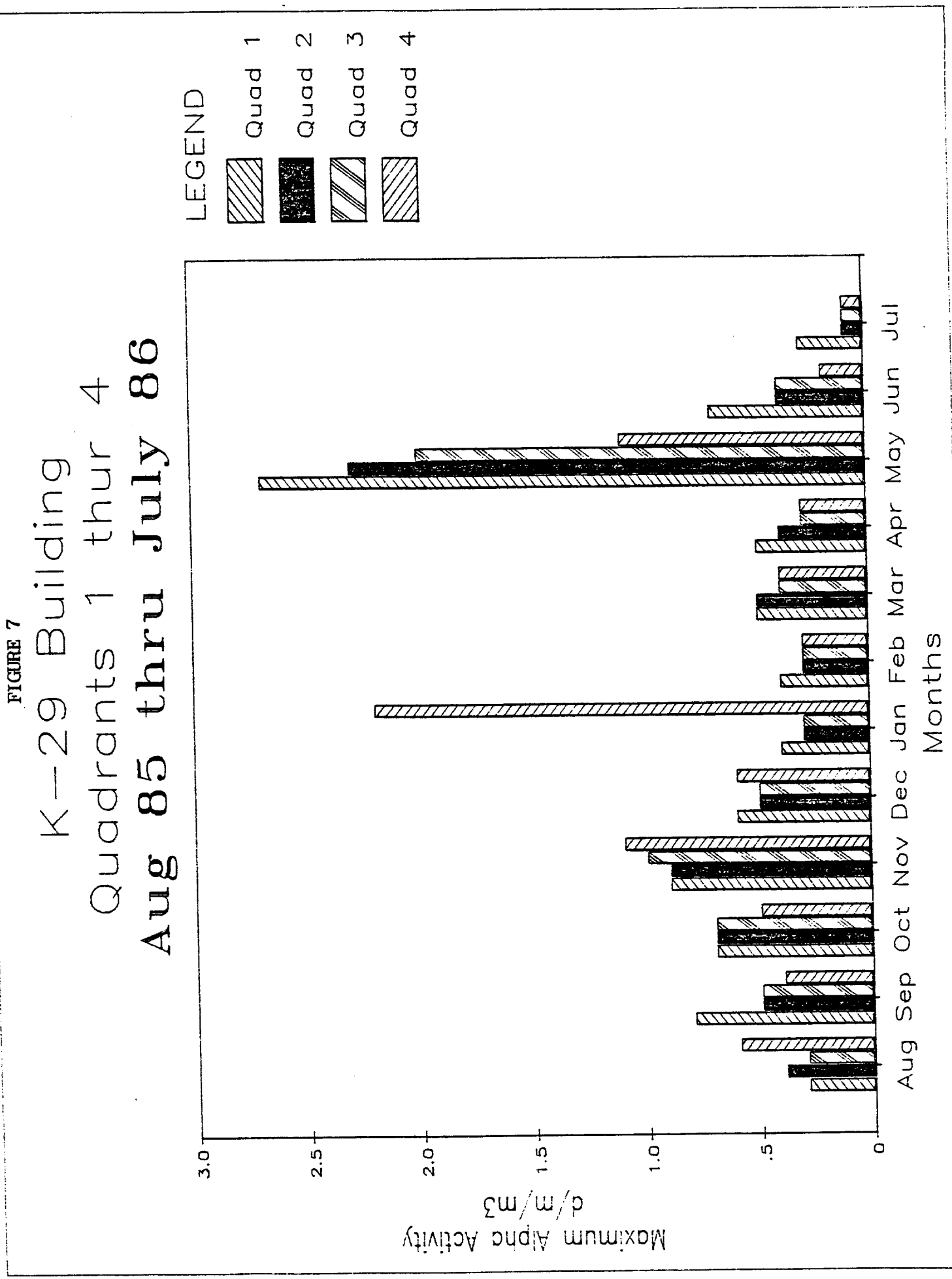

K-29 Building
Quadrants 1 thur 4
Aug 85 thru July 86
LEGEND
Quad 1
Quad 2
Quad 3
Quad 4
Maximum Alpha Activity
d/m/m3
3.0
2.5
2.0
1.5
1.0
.5
0
Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul
Months

FIGURE 8

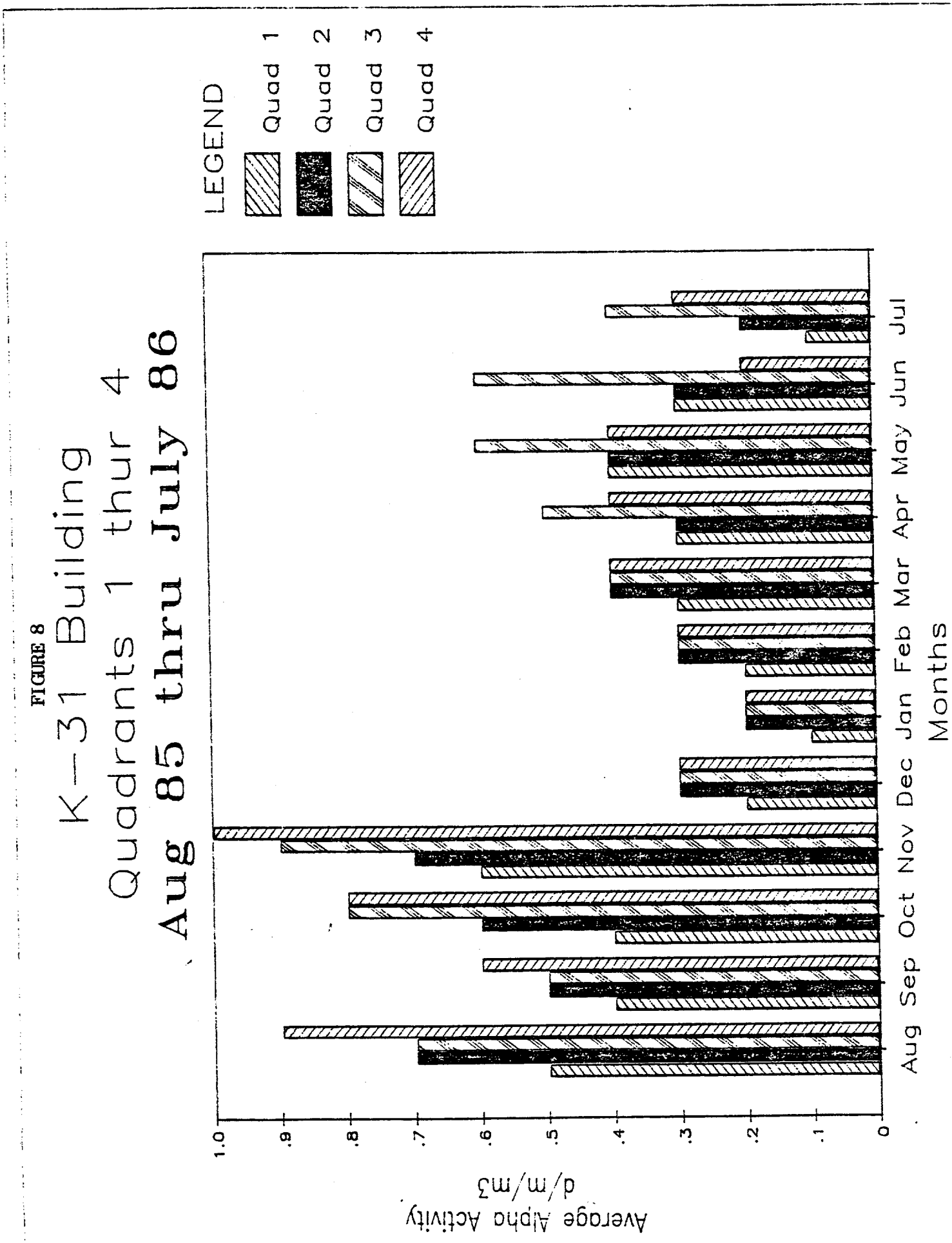

K-31 Building
Quadrants 1 thur 4
Aug 85 thru July 86
LEGEND
Quad 1
Quad 2
Quad 3
Quad 4
Average Alpha Activity
d/m/m3
1.0
.9
.8
.7
.6
.5
.4
.3
.2
.1
0
Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul
Months

FIGURE 9

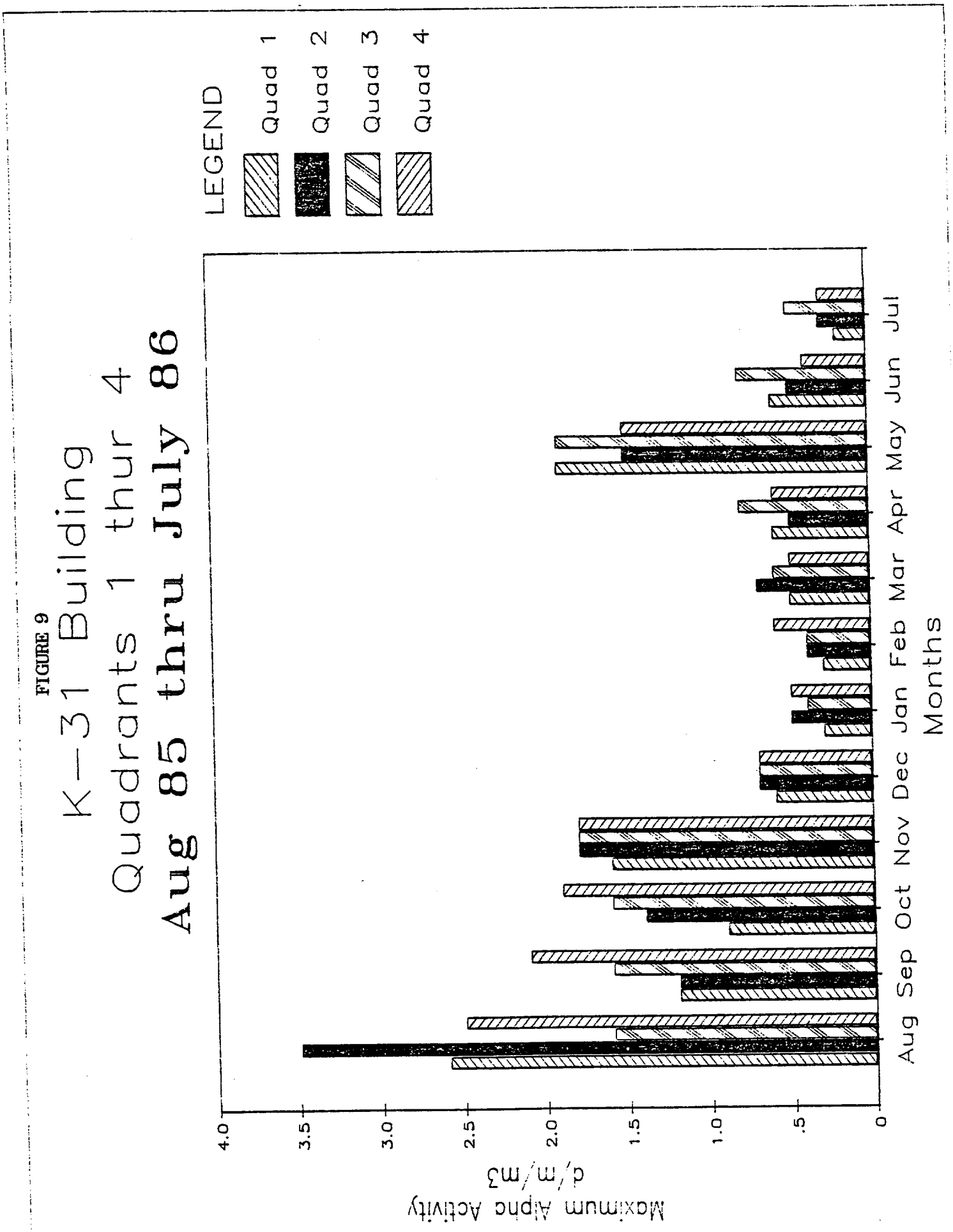

K-31 Building
Quadrants 1 thur 4
Aug 85 thru July 86
LEGEND
Quad 1
Quad 2
Quad 3
Quad 4
Maximum Alpha Activity
d/m/m3
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul
Months

FIGURE 10

K-33 Building
Quadrants 1 thur 4
Aug 85 thru July 86

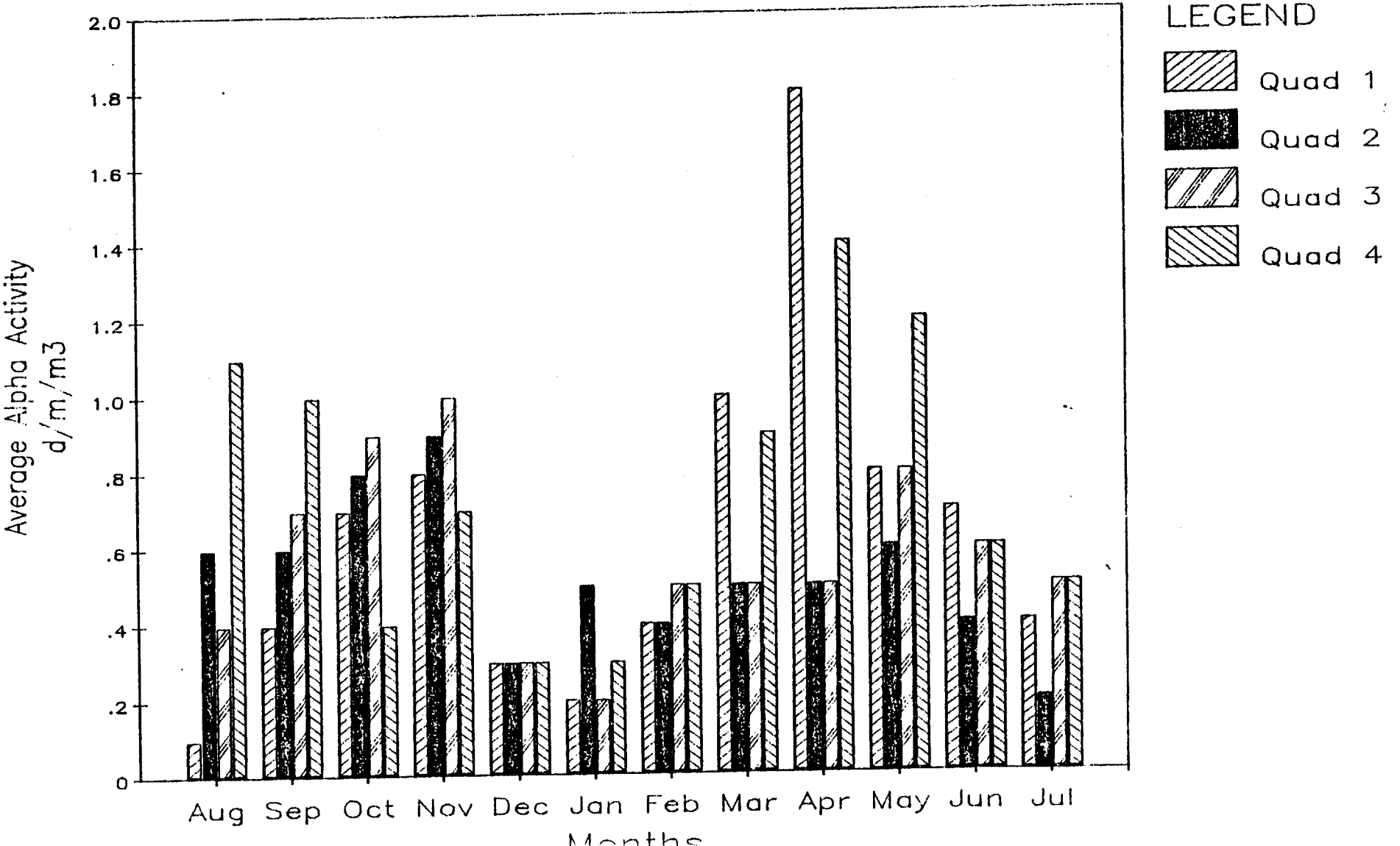
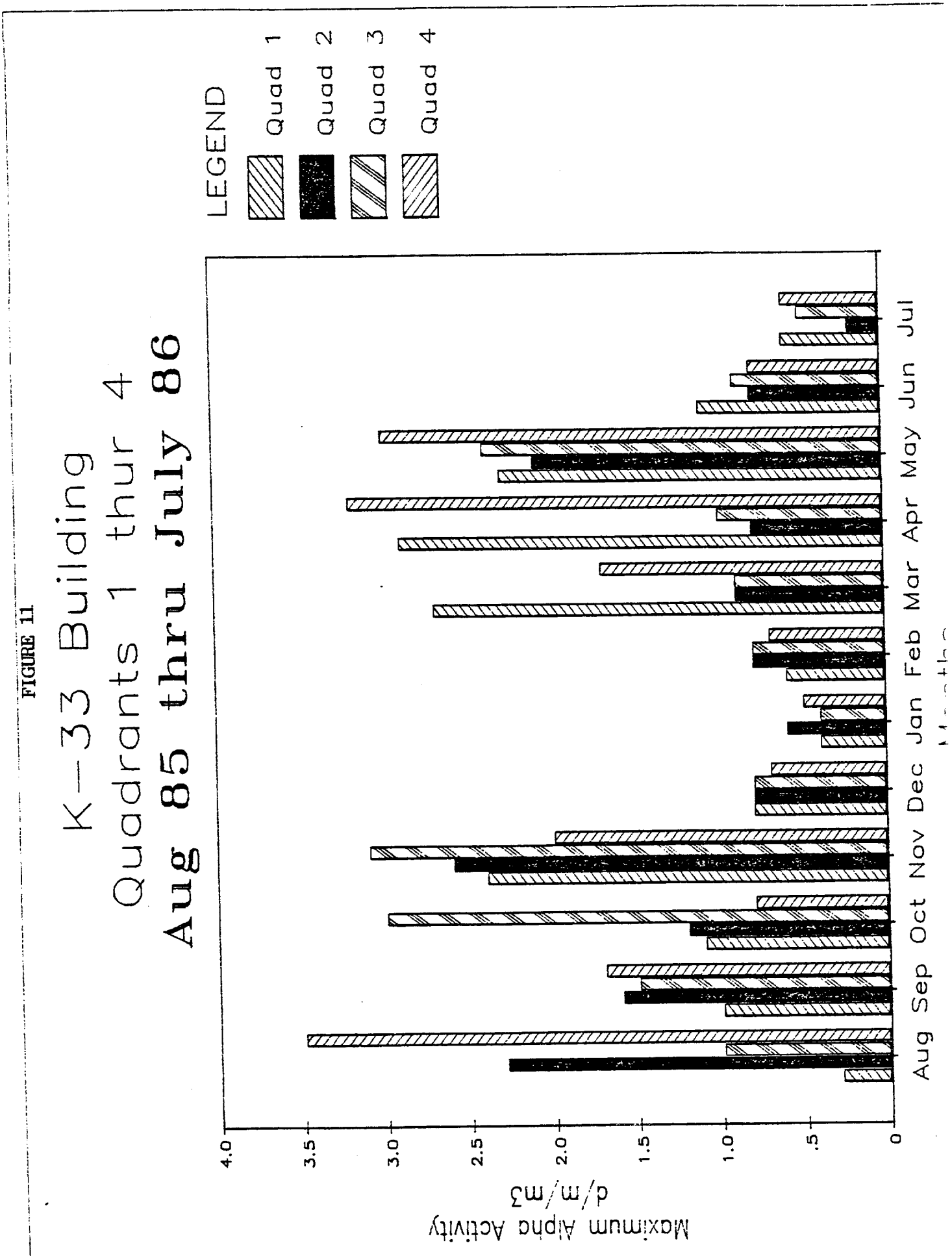


FIGURE 11


K-33 Building
Quadrants 1 thur 4
Aug 85 thru July 86
LEGEND
Quad 1
Quad 2
Quad 3
Quad 4
Maximum Alpha Activity
d/m/m3
4.0
3.5
3.0
2.5
2.0
1.5
1.0
.5
0
Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul

APPENDIX I

Appendix I

DERIVED LEVELS FOR URANIUM AND TECHNETIUM-99 at ORGDP are provided below:

A. Initial Action Level: Value at which levels are highlighted and specific investigations may be initiated.

B. Administrative Control Level: Value at which scope and depth of investigation will be increased, diagnostic samples taken or respiratory protection recommended.

C. Respiratory Protection Level: Value at which respiratory protection is required. Administrative and engineering controls are carefully reviewed and evaluated. Facility or equipment may need to be upgraded.

Derived Levels for Average Long-Term Air Contamination Samples

Material	Derived Levels Decision Levels A	B	C
Uranium (dpm/m3)	22	110	222
Technetium (dpm/m3)	13,000	66,000	133,000

DISTRIBUTION

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